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# "De-Extincting" Long-Vanished Animal Species?

***"Even if de-extinction efforts do not seem to cross fundamental ethical lines, it behooves us to try to be clear, open, and ecologically-rigorous about the purposes, motivations and goals that undergird these endeavors."***

Several private companies have set out to "resurrect" extinct species using DNA and cloning technologies, with ongoing efforts to revive the dire wolf, wooly mammoth, dodo bird and various other ancient species.

Today's "de-extinction technology" remains limited. It typically allows for the introduction of a small number of genetic changes into currently existing species, modifying individual animals to varying degrees so they resemble, and even behave like, animals that have long been out of existence.

Recent news reports declaring that Colossal Biosciences has managed to "resurrect" the dire wolf took this approach, introducing a couple dozen genetic changes into the genome of a modern-day gray wolf. The company produced a captivating animal that nevertheless retains most of the gray wolf genome. Although the animal looks and behaves differently from a gray wolf, it is not yet a dire wolf, but constitutes, at best, a kind of hybrid between the two species.

Are there any potential ethical concerns that arise concerning such animal de-extinction protocols?

There are a few.

One is that the use of CRISPR technology as a tool for revival and manipulating animal genetic codes involves very complex science. It is still the case, despite progress in the field, that unforeseen effects and troublesome traits, like heightened aggressiveness, strange growth patterns, or various birth defects could unexpectedly arise. Mistakes may come at a high cost if we can't put the genie back into the bottle when something goes awry.

Another ethical concern involves the so-called dire wolves being kept in very large enclosures in undisclosed locations, to protect them from the prying eyes of the public and from other potential predators. By restoring only a small number of animals, they end up existing without a large reference group of their peers, never being released into the wild, and growing up mostly isolated and in captivity. Is it a good idea to be bringing back extinct animals that cannot roam free and participate in a natural habitat?

"If this is always going to be a zoo animal, then stop," argues ecologist Ben Novak, a researcher interested in genetically rescuing endangered and extinct species in San Francisco. He says that the goals of de-extinction "have to be about ecological restoration and function."

Ecological niches, however, can be very complex and unpredictable, even if there have been some occasional "rewilding" success stories, such as when wolves were reintroduced into Yellowstone National

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Park in 1995 in an attempt to cull the large number of elk.

Yet as David Blockstein, senior scientist at the National Council for Science and the Environment observes,

> Bringing back extinct species sounds romantic, but it's a distraction. The ecosystems they lived in are gone or radically changed, and we're likely to create invasive species problems rather than restore balance." Or as synthetic biologist Lynn Rothschild notes, "We're gambling with ecosystems that are already fragile.

When novel species have been introduced to natural settings in the past, they have sometimes wreaked ecological havoc, proving to be more damaging than anticipated, and negatively affecting other animals within the same habitat.

For example, when cane toads were introduced in Australia in an attempt to control pests, they spread rapidly and caused a significant decline in native predator populations because they were toxic when consumed by many native species. The law of unintended consequences can raise its ugly head in unforeseen ways when attempting to introduce changes to complex systems.

When we consider that many millions of species have already gone extinct, an additional ethical issue arises: who should determine which ones deserve to be resurrected? How likely is it that such decisions will end up being driven, as appears to have been the case with Colossal Biosciences, by the "flashiness" or "cultural appeal" of the animal, perhaps as a way to generate buzz and drive corporate investment? The wooly mammoth certainly garners a great deal of interest as a "charismatic mega-vertebrate," and it's not a stretch to suppose that companies might be drawn to de-extincting certain animals based on their glitziness and potential for generating venture capital rather than strictly ecological grounds.

The massive funding and scientific efforts that are required for de-extinction projects are also likely to divert resources from less expensive efforts to protect currently endangered species. If we can just bring back extinct species, isn't that likely to sap the motivation out of conservation efforts trying to prevent extinction in the first place? It is always simpler to preserve what we already have than to go through the trouble of recreating it again.

While de-extinction efforts raise ethical concerns, they do not seem to cross fundamental ethical lines. While there is nothing in principle that should make us object to the use of genetic engineering to introduce major modifications to animals, it behooves us to try to be clear, open, and ecologically-rigorous about the purposes, motivations and goals that undergird these endeavors.

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